M2Z networks

September 29, 2008

Via Electronic Filing

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, SW, TW – A325
Washington, DC 20554

> **Re: WT Docket Nos. 07-195 and 04-356 – Notification of Oral Ex Parte Presentation**

Dear Ms. Dortch:

On September 26, 2008, Paul Kolodzy, Chuck Beam and the undersigned on behalf of M2Z Networks, Inc. met with Paul Malmud, Blaise Scinto, Mary Liebman, Ahmed Lahjouji, James Szeliga and Patrick Forster from the Wireless Telecommunications Bureau and the Office of Engineering and Technology.   During the meeting, we demonstrated that the results from the FCC-observed AWS-3 tests on September 3-5 generally supported the rules for AWS-3 that were proposed by the Commission in June 2008. Enclosed is a presentation provided.

Pursuant to Section 1.1206(b) of the Commission rules, an electronic copy of this letter is being filed. Please let me know if you have any questions regarding this submission.

Sincerely,

Uzoma Onyeije

cc: Paul Malmud   Blaise Scinto
       Mary Liebman   Ahmed Lahjouji
       James Szeliga   Patrick Forster

Analysis of AWS-1 Effective Served Signal Limited by Unlicensed Radiators and Adjacent AWS Operators – A Comparison with AWS-1/AWS-3 Coexistence Performance Limits

26 September 2008

Overview

- **Results from T-Mobile Testing consistent with UK OOBE testing on 2.1 GHz 3G equipment**
- **Only limited results from T-Mobile Testing can be used for Adjacent Channel Interference analysis (with external filter)**
- **Protection levels of -85 to -90 dBm are consistent with current technical rules including spurious emissions;**
- **Analysis from UK and T-Mobile OOBE Testing is consistent with FCC proposed OOBE rules and with 42 dBm EIRP!**

Freedom. Innovation.

AWS-3 Test Results Also Conform with Ofcom Results in Europe

Technical Rule	FCC June Proposal	UK's Ofcom Results April 2008	AWS-3 Test Results (Static)	AWS-3 Test Results (Statistical)	AWS-3 Broadband Opponents
OOBE (per MHz)	60+10 log(P)	49+10log(P)	59+10log(P)	48+10log(P)	90+10log(P)
Transmit Power	23 dBm/MHz	31 dBm	42 dBm	31 dBm	23 dBm
Spectrum Band	25 MHz	25 MHz	25 MHz	25 MHz	12 MHz
Required Guard band	0 MHz	0 MHz First adjacent 5 MHz with power limits	0 MHz	0 MHz	12-13 MHz
Assumed AWS-1 Received Signal Limit	Not Known	-85 dbm	-90 dbm	-90 dbm	-105 dbm

Out-of-Band Emission Analysis
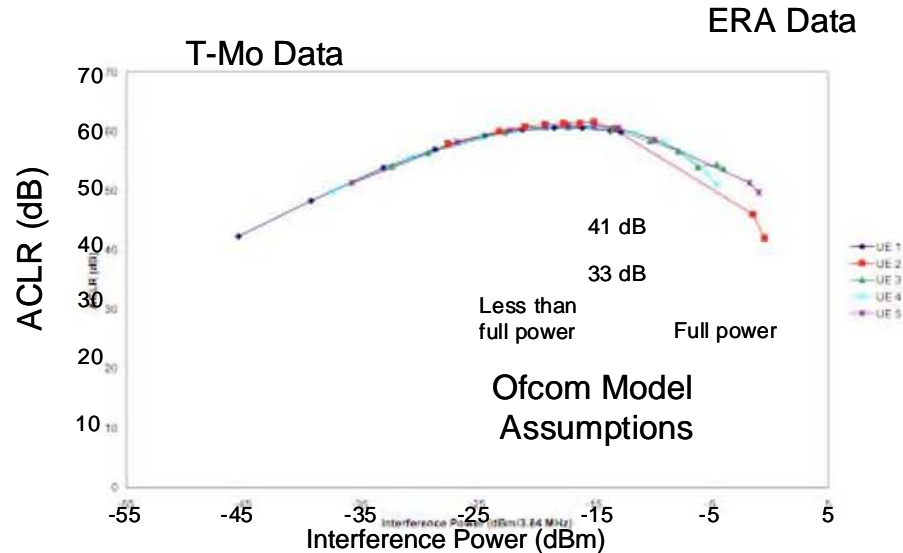
T-Mobile OOBE Results

Figure 11: Measured ACLR of the interferer at the adjacent channel (+5 MHz)
Measured ACLR for AWS-1 Receivers at 1st Adjacent Channel
Compared with Values Used in Ofcom Model

- **ACLR measurements are better than Ofcom assumptions**
- **Ofcom analysis concludes that 49 + 10 log (P) is sufficient protection**

Freedom. Innovation.

Impact of Common Local Radiators on AWS-1 at Various Served Signal Levels

Interference Source

AWS-1 Signal Level	Bluetooth @ 0.5 m	WiFi @ 1 m	Adjacent Band AWS @ 5 m	MW Oven @ 3 m
- 105 dBm	Fail	Fail	Fail	Fail
- 100 dBm	Fail	Fail	Fail	Fail
- 95 dBm	Fail	Marginal	Fail	Pass
- 90 dBm	Marginal	Pass	Fail	Pass
- 85 dBm	Pass	Pass	Marginal	Pass
- 80 dBm	Pass	Pass	Pass	Pass

Pass or **Fail** indicates ability of AWS-1 to initiate call

- -90 dBm AWS-1 Signal Strength is lowest level protected by current FCC Technical Rules
- Consistent with FCC UWB ruling for PCS minimum signal

47 CFR Sections 15.209* and 15.109* Provide Limits for Intentional and Unintentional Radiators

Field-strength may not exceed 500 uV/m at AWS-1 frequencies at 3m

0.5 meter

Unlicensed Device Transmitters

Potential AWS-1 Device Receiver

- **This limit results in allowable interference of - 74 dBm at 0.5 meter**
  - » Convert 500 uV/m field strength to isotropic received power
  - » Adjust for difference in propagation loss at 0.5 meter vs 3 meters
- **Apply 5 dB loss for body & antenna mismatch at receive end**
  - » Effective interference power at receiver is – 79 dBm at 0.5 meter

* The 500 uV/m limit is not specific to 47 CFR 15.247 but for the more limiting case of protecting the 2.1735-2.1905 MHz band

47 CFR Sections 15.209 and 15.109 Provide Limits for Intentional and Unintentional Radiators

Field-strength may not exceed 500 uV/m at AWS-1 frequencies at 3m

1 meter

Unlicensed Device Transmitters

Potential AWS-1 Device Receiver

- **This limit results in allowable interference of - 80 dBm at 1.0 meter**
  - » Convert 500 uV/m field strength to isotropic received power
  - » Adjust for difference in propagation loss at 1.0 meter vs 3 meters
- **Apply 5 dB loss for body & antenna mismatch at receive end**
  - » Effective interference power at receiver is – 85 dBm at 0.5 meter

47 CFR Section 27.53(g) Provides Limits for Adjacent Channel AWS Femto Cell Operators

~3meters

OOBE May not exceed 43 + 10 log (P) below transmitter PSD at adjacent band AWS-1 frequencies

Potential AWS-1 Device Receiver

Adjacent Band AWS Femto Cell Base Transmitter

- **This limit results in allowable interference of - 61 dBm at 3 meters**
  - » Calculated for femto-cell operator in adjacent band
  - » Allowable OOBE emission is -13 dBm/MHz, assume -18 dBm/MHz
  - » Free-space propagation loss at 3 meters = 48.6 dB
- **Apply 5 dB loss for body & antenna mismatch at receive end**
  - » Effective interference power at receiver is – 66 dBm at 3 meters

47 CFR Section 18.305 Provides Limits for Unintentional ISM Radiators (Microwave Ovens)

Field-strength may not exceed 15 uV/m at AWS-1 frequencies at 300m

3 meters

Potential AWS-1
Device Receiver

500 Watt
Microwave Oven

- **This limit results in allowable interference of - 80 dBm at 3 meters**
  - » Convert 15 uV/m field strength to isotropic received power
  - » Adjust for difference in propagation loss at 3 meters vs 300 meters
- **Apply 5 dB loss for body & antenna mismatch at receive end**
  - » Effective interference power at receiver is – 85 dBm at 3 meters

Summary – Protection Level

- **Selecting a minimum protected AWS-1 served signal any lower than - 90 dBm makes no sense when considering the ambient environment comprised of unlicensed devices and adjacent block AWS operations**

- **Establishing a minimum protected served signal of -85 $\rightarrow$ -90 dBm would seem reasonable to avoid burdening AWS-3 with limits that are already exceeded frequently in the ambient environment**
  - » Consistent with WCS Coalition

T-Mobile OOBE Testing

Serving Signal: 5 MHz UMTS centered at 2152.5MHz

Received Serving Pilot RSCP levels (dBm)	5 MHz UMTS Interference Signal			
	0 MHz Guard Band (2157.5MHz)	5 MHz Guard Band (2162.5MHz)	15 MHz Guard Band (2172.5MHz)	20 MHz Guard Band (2177.5MHz)
-105 dBm	-44.2	-43.2	-43.2	-45.2
-100 dBm	-37.2	-34.2	-34.2	-35.2
-90 dBm	-29.2	-23.2	-24.2	-25.2
-85 dBm	-27.2	-20.2	-18.2	-20.2
-75 dBm	-11.2			

Inferred Signal

-23 dBm

54 dBc

47 dBc

OOBE (without external AWS-3 Tx Filter)
Serving = 2152.5 MHz and Interference = 2152.5 MHz

Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)
-105 dBm	-96.2
-100 dBm	-89.2
-90 dBm	-77.2
-85 dBm	-72.2

-70 dBm

-77 dBm

- **The testing indicates that a -90 dBm AWS Signal Strength can accept -77 dBm OOBE signal level;**
- **Through inference, the OOBE signal is approximately 54 dBc below the AWS-3 emulated signal**

Out-of-Band Emission Limits (Static)

		-77 dBm
Normal Propagation Loss	3 m	48 dB
Slot Mismatch Gain		0 dB
Antenna Mismatch		2 dB
Body Loss		3 dB
OOBE Slope		2 dB
OOBE Limit (5 MHz)		-22 dBm
OOBE Limit		-29 dBm/MHz

- **Protecting to currently allowed protection levels of -90 dBm**
- **Using OOBE measurement from T-Mobile Testing**
- **Provides a OOBE Limit of -29 dBm/MHz or 59 + 10 log (P) to protect AWS-1 handsets**

Out-of-Band Emission Limits (Statistical)

Protected level		-16 dBm	
Filter Attenuation		5 dB	
Slot Mismatch Gain		0 dB	Ofcom Analysis
Antenna Mismatch		2 dB	
Body Loss		3 dB	
Prop Loss	3 m	48 dB	
Transmit Power		42 dBm	

- **Protecting to currently allowed protection levels of -90 dBm (-77 dBm AWS-3 OOBE level)**
- **Using OOBE measurement from T-Mobile Testing**
- **Provides a OOBE Limit of -18 dBm/MHz or 48 + 10 log (P) to protect AWS-1 handsets**

Adjacent Channel Emission Analysis

Adjacent Channel Testing Indicates Incorrect Procedures

Serving = 2152.5 MHz (F2)	Interference = 2162.5 MHz
Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)
-105 dBm	-43.2
-100 dBm	-34.2
-90 dBm	-23.2
-85 dBm	-20.2

Serving = 2152.5 MHz (F2)	Interference = 2177.5 MHz
Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)
-105 dBm	-45.2
-100 dBm	-35.2
-90 dBm	-25.2
-85 dBm	-20.2

Serving = 2152.5 MHz (F2)	Interference = 2315 MHz
Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)
-105 dBm	
-100 dBm	
-90 dBm	-25.2
-85 dBm	

| Serving = 2152.5 MHz (F2)	Interference = 2172.5 MHz
Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)
-105 dBm	-43.2
-100 dBm	-34.2
-90 dBm	-24.2
-85 dBm	-18.2

Serving = 2152.5 MHz (F2)	Interference = 2197.5 MHz
Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)
-105 dBm	
-100 dBm	
-90 dBm	-23.2
-85 dBm	
-90 dBm	-23.2

Serving = 2152.5 MHz (F2)	Interference = 2412 MHz
Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)
-105 dBm	
-100 dBm	
-90 dBm	-25.2
-85 dBm	

- **As the emulated AWS-3 signal is moved further away, the interference signal strength should increase … it does not, even at point 250 MHz away**
  - » Probably being corrupted by test signal generator noise floor
- **Either the test signal was inaccurate or WiFi signals at 2412 MHz would cause interference**
- **Can we get something of value out of the ACI testing???**

Adjacent Channel Interference Data from Filtered Tests
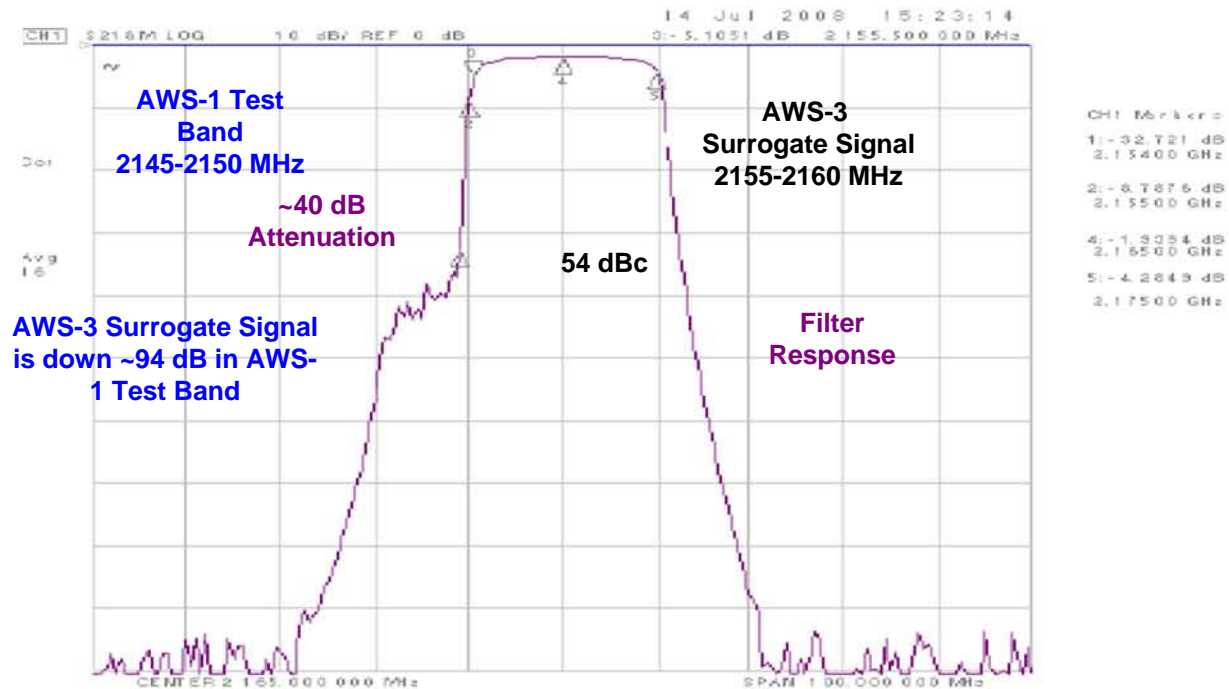
- **Since AWS-3 Surrogate Signal is down 94 dB, the measurements correspond to an isolated Adjacent Channel Interference Test**

External Filter Data allows some ACI Values to be Determined

Test Type: Receive Overload Tests
Date and time: 09/03/08, 2-4pm
Serving Signal: 5MHz UMTS
Interfering Signal: 5MHz UMTS
Interfering Bandwidth: 5 MHz
External AWS-3 TX Filter: Yes

Rx Overload Tests (with external AWS-3 Tx Filter)

Serving = 2142.5MHz (E) Interference = 2157.5MHz

Serving Pilot Received Signal Code Power (RSCP) (dBm)	AWS-1 Mobile received Interference Signal Strength when Setup Failure occured (dBm)	Pilot Channel (CPICH) Ec/Io Reported at the Mobile when Setup Failure occured (dB)	Formula used: -6.2 dBm is the SigGen Interference Tx Pwr 5 dB is the Interference Pathloss between the SigGen and the AWS-1 Mobile Under Test -6.2 - 5 - Attenuation = AWS-1 Mobile Rx	
-105 dBm	-27.2	-14	-6.2 - 5 - 3 - 13	= -27.2
-100 dBm	-23.2	-13.5	-6.2 - 5 - 3 - 9	= -23.2
-90 dBm	-16.2	-13.5	-6.2 - 5 - 3 - 2	= -16.2
-85 dBm	N/A	Ran out of attenuation		

- **External filter testing allows to separate OOBE and ACI effects**
  - » Limited Data was collected

- **At -90 dBm protection, -16.2 dBm was signal level that produced a failed call setup**

Power Emission Limits (Static)

Protected level		-16 dBm
Filter Attenuation		5 dB
Slot Mismatch Gain		0 dB
Antenna Mismatch		2 dB
Body Loss		3 dB
Prop Loss	3 m	48 dB
Transmit Power		42 dBm

- **T-Mobile Testing unfortunately did not decouple Out of Band Emissions and Adjacent Channel Interference (Blocking)**
  - » However, one test could be analyzed to infer an isolated ACI
- **Protection levels of -16 dBm is used in analysis**
  - » Directly from T-Mobile Testing; or
  - » Use Ofcom (-10 dBm) – 6 dB (conservative) protection level,
- **Assume 5 dB attenuation for proper AWS-1 duplex filter**
- **Provides a Emission Limit of 42 dBm which is consistent with Ofcom analysis**

AWS-3 Test Results Also Conform with Ofcom Results in Europe

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Spectrum Band	25 MHz	25 MHz	25 MHz	25 MHz	12 MHz
Required Guard band	0 MHz	0 MHz First adjacent 5 MHz with power limits	0 MHz	0 MHz	12-13 MHz
Assumed AWS-1 Received Signal Limit	Not Known	-85 dbm	-90 dbm	-90 dbm	-105 dbm

Summary

- **OOBE Analysis**
  - » T-Mobile OOBE data with Ofcom analysis concludes:
    - 49 + 10 log (P)
  - » T-Mobile OOBE data with spurious emission analysis concludes
    - 48 + 10 log (P) from statistical analysis
    - 59 + 10 log (P) from static analysis
- **Adjacent Channel Power Limit Analysis**
  - » T-Mobile testing methodology flawed, however using the data with the external filter provides important ACI data
  - » Isolated ACI from T-Mobile Tests concludes:
    - 42 dBm
- **These results are from worst case scenarios using the Ofcom and non-statistical analysis techniques. They do not address the base-to-base interference scenarios.**
- **QED**